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China Report

AGRICULTURE

No. 62

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CHINA REPORT

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I. GENERAL INFORMATION

AGRICULTURAL MODERNIZATION DISCUSSED

Priority to Fertilizer

Beijing GUANGMING RIBAO in Chinese 2 Aug 79 p 2

[Article by Deng Fengyi [6772 7364 0308] of the Agriculture Bureau, Jingzhou Prefecture, Hubei Province: "Two Proposals on Carrying Out China's Agricultural Modernization"]

[Excerpt] Priority in China's Agricultural Modernization Should Be Given to Developing Chemical Fertilizer.

In carrying out China's agricultural modernization, excatly where should be begin at present? What should we change first? Where should the investment be concentrated? This is now a major question urgently requiring a solution. In my opinion, we should place priority on the development of chemical fertilizer. This is a key measure which would enliven the entire situation in agriculture.

The principal tasks of agricultural modernization are two: one is to raise agricultural output and the other is to raise labor productivity. China has many people and a small cultivated area. Our farm crop output is low, but the potential for clearing new land is not great. Therefore we have to rely principally on increasing unit yield to increase the output of grain. Because China's industry is backward and its agricultural population numerous, the employment problem of the large amount of labor power released through agricultural mechanization will be difficult to solve. To solve the employment problem we need to develop industry in a forceful way. At present this has still not been done. I therefore say that the principal direction of attack in developing China's agriculture at present is that we should raise output and only secondarily develop agricultural mechani[illegible]ion and raise labor productivity.

Different tasks must be completed by adopting different methods. The most key measure at present for raising the output of grain is to develop the chemical fertilizer industry to solve the fertilizer problem. Of course,

other complementary measures must be provided to increase output. Our Jingzhou Prefecture is situated on the Jianghan Plain, with natural conditions for high yields of grain and cotton. It is an important grain and cotton commodity base in China. Because chemical fertilizer is specifically used for cotton, its output is comparatively high. But the supply of chemical fertilizer for grain is very insufficient, limiting the raising of grain output. We investigated a set of high output communes and brigades and discovered that their production conditions in the areas of water control, mechanization and fine seeds were generally about the same as in most communes and brigades. The difference was that they had one advantageous condition, that they could guarantee the supply of the required amount of chemical fertilizer. Examples of this are the Baima Brigade and the No 7 Production Team of Fenglin Brigade in Jiangling County. Because these two units applied 80 catties of nitrogenous fertilizer and 50 to 100 catties of phosphate fertilizer to each mou for each crop, their annual per mou yields last year reached 1,500 catties and 1,400 catties respectively, about 75 percent higher than the prefectural average. But last year the prefecture's average application of nitrogenous fertilizer on large acreage grain crops was 9.5 catties per mou. Now if the majority of communes, brigades and teams in the prefecture could reach the chemical fertilizer application level of these two units, without changing any other conditions, the total grain output of the prefecture could reach 15 billion catties, an increase of 50 percent. Because the Baima Brigade and the No 7 Production Team of Fenglin Brigade use more chemical fertilizer, they spend over 10 yuan more per mou. This can increase grain output by 400 catties, with an income of over 60 yuan.

With chemical fertilizer, the economic effectiveness of existing water control facilities can be brought into full play. The water control conditions of Jingzhou Prefecture allow over 90 percent of the cultivated area to be secure against drought and waterlogging. Now we have water but no fertilizer, causing 1,000 catty water control facilities to only yield 600 catty effects, or to have water control benefit only 50 percent.

Chemical fertilizer is beneficial to accumulating funds for agricultural mechanization. With it, grain output increases, income increases and the communes, brigades and teams can then buy agricultural machinery and use it.

When there is chemical fertilizer, multiple economic crops can be developed. Although we have criticized the mistaken mentality of simply grasping grain since the party's Third Plenum, and have striven to develop multiple economic crops, it has been impossible to reduce the acreage of grain crops. Grain yields are low and we need to ensure total grain production and the grain tasks of the state. Therefore it has been impossible to develop multiple economic crops.

With chemical fertilizer, pig raising can be developed more rapidly. With more grain, more pigs can be raised. With more pigs, there can be more organic fertilizer which in turn can stimulate more grain output. With little grain, pig raising cannot be developed.

The lack of fertilizer is very prominent in other areas such as forestry and local specialties.

At present China's chemical fertilizer production is not only small in amount, but also deficient in quality and the number of varieties is even less. We must rapidly develop the chemical fertilizer industry in order to guarantee the various chemical fertilizer varieties required for the growth of various crops. That is the only way we can fulfill or exceed the grain production target for 1985. The investment required to develop the chemical fertilizer industry and to carry out chemical fertilization is considerably less than that for agricultural mechanization and water control in the modernization of agriculture, and it produces results quickly. The development of our chemical fertilizer industry can not only rapidly end China's abnormal lack of chemical fertilizer, but also promote the development of China's chemical industry. I also feel that developing the chemical fertilizer industry is not extraordinarily difficult. All we need is for leaders at all levels to recognize seriously the importance of developing chemical fertilizer to realizing the four modernizations and priority for using limited funds will go to developing the chemical fertilizer industry.

At the same time that we develop chemical fertilizer in a big way we must pay serious attention to doing a good job of grasping farmyard manure. At no time can we afford to neglect the important role of manure.

Japan's Path Not Necessarily Best

Beijing GUANGMING RIBAO in Chinese 2 Aug 79 p 2

[Article by Zhang Qinghe [1728 3237 3109] of the China Agricultural Mechanization Science Institute: "Bumper Output Is Not the Same as Bumper Harvest"]

[Text] The main viewpoint of Comrade Fang Yuan in his work, "Notes on Studying Foreign Experiences in Agricultural Modernization" is that the main task of China's agricultural modernization is bumper output, that is, "to raise the output per unit area." "The key" to obtaining a bumper output "lies in good seeds and chemical fertilizer." "The principal role of agricultural mechanization is to save labor power, and it does not serve very much to raise output per unit area." Therefore, except in expansive places which are thinly populated, we should follow Japan's path of "chemical fertilizer first, then mechanization."

If I have not misinterpreted the above, I have some different points of view.

First of all, bumper output is fine but it is not equivalent to a bumper harvest. There are numerous examples of this. By chance I have in front of me some materials that were jointly arranged in 1977 by seven units, including the Guangdong Provincial Agricultural Machinery Institute. In it it says, "During the rice harvest season, Guangdong Province often is affected by typhoons and continuous spells of wet weather which prevent the harvested rice from being dried in time with as much as 200 million catties

of grain or more affected by sprouting, deterioration, mildew and rot. In Zhongshan County alone the loss (of grain) is 30 or 40 million catties each year (an average of nearly 50 catties per mou)." The reasons you can get a bumper output but not a bumper harvest are two, natural disasters and the low level of agricultural mechanization. If we solve the problem of drying equipment, we can get a bumper harvest even with natural disasters. Thus agricultural mechanization's role is not simply "to save labor power." It also plays a big role in raising output. And the role of agricultural mechanization is still far from being like this. Therefore, in my opinion, we definitely should not drop agricultural mechanization to a position of no importance, of indifference.

Next, Comrade Fang Yuan feels that "the key to obtaining high output lies in good seeds and chemical fertilizer." I believe the key lies in water and fertilizer. This is because water conservancy is the lifeline of agriculture. It is just like the peasants say so often: "Whether or not there is a harvest depends on the water; how much depends on the fertilizer." If not enough moisture content is conserved, the seeds will not even be able to sprout, much less have a high yield. Therefore, no matter whether the state or the communes, brigades and teams, they must all pay serious and special attention year after year to fighting drought and draining off waterlogging. In order to reach "water when there is drought and drainage when there is waterlogging" and guarantee the normal growth of shoots, we must thoroughly develop irrigation and drainage machinery. Practice verifies that a basic stable, high yield district is one whose water control activity is relatively good. Therefore, we should not necessarily follow Japan's path of "chemical fertilizer first, then mechanization." At the same time that we strive to develop the farm chemical industry, we should stably and effectively develop our agricultural machinery industry.

But when we mechanize agriculture, how should we make arrangements for the labor power which is spared? Right now many people are concerned about this question. I think it is too early to worry about it. First we have not yet mechanized. The peasants do not dislike agricultural machinery, but they are repelled by that kind of low-grade "machinery which cheats agriculture." For example, the "Fengshou [Bumper Harvest] 1100" thresher produced by the Jiamusi Farm Machinery Plant does not appear to be of the highest quality, but because it is basically reliable it is much welcomed in northern China, to the point that it cannot even be bought if you have the money. The "Fengshou 1100" thresher is welcomed because the wheat harvest is the season in this area when agricultural activity is the busiest and most intense. The numerous operations of harvesting the wheat, plowing and transplanting all happen together and must be completed in a period which is not very long. A thresher speeds up the pace and also saves labor power. What concerns the peasants right now is not some sort of lack of arrangement of labor power but that they cannot buy good quality, reliable agricultural machines. The conditions of back breaking labor have not been fundamentally changed. Since we have not made the transformation at present, it does not seem too necessary

to be anxious about not having something to do in the future. Second, even if we had mechanized, I feel there is no need to have a relapse of professing a love for what we really fear. The countryside is vast and the labor power which has been freed can be organized to push forward in depth and breadth in production to engage in greenification, fish raising, animal husbandry and other sideline production. They can also participate in some productive activities such as rural industry. To have surplus labor power from the countryside flow into the cities is no way to go, but it is also not the way to go for a large country of 970 million people to maintain 80 percent of its population for a long time making food. To do that would mean never transforming the poor and backward aspect. Third, to put it extremely, if we count the freed labor power as not having any arrangements made for it and if some work that originally took 10 people to complete now only takes one, what's wrong with the other 9 going out and enjoying themselves? Is there some necessity for everyone to be bound by arduous labor? At this point, some comrades may raise the question that we need to spend money to buy agricultural machines, and we do not if we use people's two hands. This is of course a real problem. But I think this problem will possibly not be too difficult to resolve with the development of industrial and agricultural production, the gradual narrowing of the scissors differential for industrial and farm products and the gradual increase in peasant living standards.

Emphasize Mechanization

Beijing GUANGMING RIBAO in Chinese 2 Aug 79 p 2

[Article by Shen Zhenhua [3088 2182 5478]: "The Emphasis in China's Agricultural Modernization Should Be on Mechanization"]

[Text] The emphasis in China's agricultural modernization should be on the mechanization of all processes of agricultural production (including cultivating, intertilling, harvesting, drying, storing, applying fertilizer, weeding, crop dusting, transporting and feeding). Only then sould the chemical fertilizer industry be developed and fine seeds selected. Conditions vary considerably in the various parts of the country, so the emphasis in agricultural mechanization should differ from time to time and place to place. We cannot "cut everything with one knife."

In light of the present situation in China where the supply of farm products does not meet the demand, we urgently need to concentrate our forces to allow districts which concentrate on producing grain, cotton, edible oils and livestock to mechanize and to give priority to these districts in the supply of various kinds of fertilizer and insecticides, in order rapidly to raise labor productivity and the commodity rate. This would allow us within a short period of time to supply the cities with even more products such as grain, cotton, edible oils, meat, eggs and milk.

Some comrades feel that the role of farm mechanization in raising output per unit area is not great, but that chemical fertilizer and fine seeds can

greatly increase such yields. Therefore we should give prominence to grasping chemical fertilizer and fine seeds and not to farm mechanization. I think this viewpoint is one-sided and does not correspond to reality. Admittedly, the role of developing the chemical fertilizer industry and selecting fine seeds is really quite large in increasing output per unit area. Of course we must henceforth exert great efforts in doing a good job in this field. But we definitely cannot use this to deny the tremendous role of farm mechanization in increasing output per unit area.

According to experiments by the relevant departments, mechanized plowing (in keeping with the demands of quality) in some areas raises the per mou yield by about 70 catties over animal plowing. If all the 1.2 billion mou of grain crops in China were plowed by machine, output could be increased by over 80 billion catties. Taking mechanized irrigation and drainage as an example, in some places a mou of paddy or irrigated land yields 200 catties more grain than a mou of dry land. If 1 billion mou of grain crops in China could change into paddy or irrigated land, output could be increased by nearly 200 billion catties. For transplanting, an ordinary commune or team requires over 20 days of hand labor. With other conditions the same, transplanting half a month earlier can increase per-mou yield by about 10 percent. If 500 million mou of rice in China were transplanted by machine to finish transplanting a half month earlier, output could be increased by several 10 billions of catties each year. In harvesting, machines are more timely and cleaner than by hand. In the one province of Heilongjiang alone, complete machine harvesting could reduce losses of grain about 1 billion catties per year. For the entire country, the reduction would be about 20 billion catties per year. Also, American agriculture basically produces one crop a year, but most places in China have three crops in two years, two crops in one year or three crops in one year. With labor done by hand, when harvesting, threshing and sowing of the next crop coincide, even communes and teams with many people and little land always have too many things to take care of at the same time, lose time in farming and thus reduce their production. Furthermore, if China's agriculture were fully mechanized, we could feed 40 million fewer head of farm animals such as oxen, horses and mules (calculated at 1 head per 40 mou), saving roughly 20 billion catties of feed grain (calculating an average consumption of 500 catties per head). This grain could feed 50 million hogs (at 400 catties per head) and produce 8 billion catties of meat (at an average of 160 catties per head). The forage grass saved could feed about 40 million head of cattle and produce over 10 billion catties of meat (at an average of 400 catties per head of cattle). In this way, each of China's 900 million people could have an average of over 20 catties of pork and beef each year. These examples suffice to show the great importance of farm mechanization in raising yield and total output and in solving the problem of the supply of farm products not meeting the demand.

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TEST METHODS NO 14, 15 FOR PADDY RICE CULTIVATION DESCRIBED

Shanghai SHUIDAO ZAIPEI SHENGLI [PHYSIOLOGY OF PADDY RICE CULTIVATION] in Chinese 1978 pp 419-423

[Text] 14. Methods of Field Inspection

In production, it is necessary to grasp the progress of growth and development of paddy rice so as to work out cultural and management measures in an even better way. For example: It is necessary to understand the growth condition of tillers in order to determine what measures to take to either promote or control growth. Or, it is necessary to ascertain the ear forming stage so as to strengthen soil water management and avoid a serious shortage of water. Sometimes it is also necessary to inspect the progress of growth and development of paddy rice for a certain purpose, or on account of a certain test.

Generally, field inspection consists of two kinds: record keeping during the growth period and inspection of growth and development conditions.

I. Record Keeping During Growth Period

(1) Seeding time: Actual date of sowing (month/day--same hereunder).

(2) Sprouting stage: The day that the first leaves of 50 percent of the rice seedlings emerge from the plumule sheaths and leaf color begins to turn green.

(3) Transplanting time: Actual date of transplanting.

(4) Green-up stage: After transplanting, at noon on a clear day when the vexillary leaves of over 50 percent of the plants unfold anew.

(5) Tillering period: The early stage of tillering is when new tillers of 10 percent of the plants emerge from the leaf sheats. When new tillers of 50 percent of the plants emerge, it is the tillering period. Peak tillering is when tillering reaches a maximum.

(6) Jointing stage: Jointing is the stage when the first above-ground internodes of 50 percent of the plants extend to a certain length. For early cropping rice it should be over 1 centimeter, and for late rice it should be over 2 centimeters.

(7) Ear forming stage: The ear forming stage is the period when the boot leaves of 50 percent of the plants have emerged completely from the leaf sheaths and the leaf sheaths have appeared in the shape of a "spindle."

(8) Earing stage: The initial stage of earing is when apical spikelets of 10 percent of the rice panicles have emerged from the leaf sheaths of the boot leaves. The earing stage is when apical spikelets of 50 percent of the panicles have emerged. The full earing stage is when apical spikelets of 80 percent of the panicles have emerged.

(9) Date of maturation: The date of maturation is when over 90 percent of the grains has reached a degree that they cannot be crushed with the fingernails.

II. Inspection of Growth Conditions

A. Inspection of the Makings of Rice Seedlings

Prior to pulling out the rice seedlings for transplanting, select a representative seedling planting board and lining it at right angles to the plant ridge, collect 25 to 50 young plants as samples to measure the following items:

(1) Number of leaf blades (exclude imperfect leaves) and number of green leaves (do not include new leaves that have not spread out) in order to determine the mean value of a single plant.

(2) Height of seedling: Measure the height in centimeters from the basal part of a seedling to the apex of its longest leaf blade.

(3) Number of tillers: Determine the average number of tillers on a single plant and the percentage of tillering seedlings. (Also, the percentages of seedlings bearing different numbers of tillers may be determined.)

Percentage of tillering seedlings (%) = number of rice seedlings with tillers $\div$ total number of rice seedlings determined x 100.

(4) Width of basal part of rice seedling: Take 20 rice seedlings at random and lay them on a level surface side by side, closely together. Measure in centimeters the basal parts of the seedlings (excluding those with tillers) at their widest points and determine the mean value.

(5) Dry weight of aerial part: Collect samples and weigh parts, excluding root systems, after drying in the sun or in a desiccator. Determine the mean value of a single plant in milligrams.

B. Tillering Period

Fix four or five points in a large field, or one or two points in a small area. At each point, fix 5 to 10 holes at right angles to the direction of transplanting. After the green-up stage, count the number of basic seedlings and the total number of stems and shoots (including the main stems and tillers). Thereafter, note any increase or decrease in the total number of stems and shoots every 3 to 5 days until the earing stage is reached.

Determine according to the situation of the tillers the initial stage of tillering, full tillering, peak tillering, and final stage of tillering.

C. Differentiation of Young Spikes

Young spikes of early cropping rice begin differentiation just before the jointing stage. With intermediate rice, jointing and young spike differentiation occur at the same time. Young spikes of single-crop late-maturing rice will not begin undergoing differentiation until 10 to 15 days after jointing. The process of young spike differentiation and development may be divided into eight stages, namely: differentiation stage of the first bract, differentiation stage of primary branch primordia, differentiation stage of secondary branch primordia and spikelet primordia, formation stage of pistil and stamen, formation stage of pollen mother cells, meiosis stage of pollen mother cells, filling stage of pollen, and maturation stage of pollen grains.

D. Rate of Seed Filling

Beginning with the earing stage, mark uniformly with signs those spikes with the same date of earing (taking as the basis the time when the tip of the spike has emerged not more than 2 centimeters from the sheath of the boot leaf). Thereafter, measure the rate of increase in the 1,000-grain weight of the oven-dried grains from 10 spikes (at the final measurement the spike axis should be weighed separately after grains are separated from it and the weight deducted) at intervals (of 5 to 10 days, depending on specific items).

E. Conditions of Lodging

Keep a record of the time, acreage, and degree of lodging. The acreage of lodging is determined by the method of measurement with the eye and expressed in terms of percentage. The degree of lodging is divided into three stages, namely: slanting, bending over, and lying flat on the ground. Also, note the date of inspection. Erect: Plant is upright or forms an angle greater than 75° with the ground. Slanting: Plant forms an angle between 60° and 75° with the ground. Bending over: Plant forms an angle between 30° and 60° with the ground. Lodging: Plant forms an angle less than 30° with the ground.

15. Methods of Yield Measurement and Seed Testing

Yield measurement and seed testing are generally conducted approximately 1 week before harvest. Early measurement of grain yield is of benefit to the arrangement of work schedules, but the actual number of grains per spike and weight per 1,000 grains obtained are not too accurate and do not exactly correspond with actual production. The closer to harvest time the measurement is taken, the more reliable the anticipated yield.

Method of yield measurement by sampling: Prior to the determination of sampling points, obtain a full understanding of the growth and development conditions of the paddy rice in the field. Sampling points should be enough like the others to be representative and errors in their selection should be reduced as much as possible. In general, the method of five-point sampling along a diagonal line is adopted. The number of sampling points and the method of sampling may be modified correspondingly in accordance with the size of the field and the growth condition of the paddy rice.

(1) Measurement of distance between rows of plants and between adjacent plants in a row: At each sampling point, measure horizontally and vertically the distance of 21 or 11 holes (the measurement should be taken of the distance from the center of the first hole to the center of the 21st hole) and determine the number of holes per mu.

(2) Number of holes per mu = 600,000 square inches ÷ distance between adjacent plants in a row (inch) x distance between rows of plants (inch).

(3) Number of effective spikes: At each sampling point, take 10 adjacent holes (excluding those where no plants are growing) both horizontally and vertically and count the number of effective spikes. Obtain the average number of effective spikes per hole, then determine the number of effective spikes per mu. Effective number of spikes per mu = number of holes per mu x number of effective spikes per hole.

After the number of holes per mu and the number of effective spikes are determined, samples of plants may be taken indoors for seed testing. The plants from two holes at each sampling point may be taken. The determination of which 2 holes is based on the average number of effective spikes her hole of 20 to 10 holes. (For example: If 9.6 is the average number of effective spikes on the plants growing in 20 holes, then take the plants from 2 holes with 0 spikes and 10 spikes respectively.) These samples are then used to test for the total number of grains per spike, number of filled grains per spike, percentage of empty kernels, and weight per 1,000 grains.

(4) Height of plant: Take 25 to 50 samples of paddy rice plants and measure in centimeters the height of the main stem of each plant from its basal part to the apical spike (not including the awns).

(5) Length of spike: Take 25 to 50 samples of spikes and measure in centimeters the length of each from the node at the base of the head to the tip (not including the awns).

(6) Number of filled grains per spike: Determine the average number of filled grains (not including empty kernels and half-filled grains) per spike.

(7) Percentage of empty kernels and half-filled grains: Half-filled grains are grains that are less than two-thirds filled and empty kernels are grains that are completely unfilled. For testing, the water flotation method may be used. Those that sink to the bottom of the water are filled grains; those that float in or on the surface are either empty kernels or half-filled grains.

Percentage of empty kernels and half-filled grains (%) = average total number of grains per spike--average number of filled grains per spike ÷ average total number of grains per spike x 100.

(8) Weight per 1,000 grains: Take at random 1,000 dry grains from the above materials and ascertain their weight in grams. Repeat the weighing and take the average. It is considered as correct if the difference between the two weighings is not greater than 3 percent of the mean value. (If the mean value is 30 grams, the difference between the 2 weighings must not be greater than 0.9 gram.) If the difference is greater than 3 percent, then another batch of dry grains must be obtained and weighed, and the mean value of 2 weighings that are nearly the same is taken as the weight per 1,000 grains.

(9) Theoretical yield:

Theoretical yield (jin/mu) = number of effective spikes per mu x number of grains per spike x weight per 1,000 grains (gram) ÷ 500 x 1,000.

(10) Actual yield per mu: The per mu yield is calculated from the weight of unhulled rice after it is sun-dried, winnowed and actually weighed. It is considered as appropriate if the weight of unhulled rice is calculated according to the standard that its moisture content is 15 percent and its percentage of impurity is 1.5 percent.

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REPORT ON BREEDING OF 'THREE LINES' OF MALE STERILITY IN POLYPLOID RICE

Beijing YICHUAN [HEREDITAS] in Chinese No 2, Mar 79 pp 1-4

[Article by Tan Xiehe [6223 0588 0735] of the Agricultural Research Institute of Qiannan Autonomous Zhou, Guizhou Province]

[Text] Common diploid (2n) rice, when artificially induced to double chromosomes (4n), appears huge in overall form in comparison with tetraploids and diploids. Stems are sturdy; leaves are dark and rich in color; and spikelets, pollen grains, and grains within the husks show remarkable increases in size. But tillering strength has weakened, development has become protracted, and fruiting rate lowered to a large degree, the number of kernels of grain reduced, the number of only partially formed grains increased, and the quality of the rice changed for the worse. Therefore, primitive tetraploid rice varieties cannot be readily used directly in production, but their special characteristics of universally and outstandingly large kernels have received the attention of breeders. Some research units that have had experience with the hybrid breeding of tetraploid rice have made improvements, in varying degrees, to the shortcomings of polyploid rice. But with polyploid rice, as with diploid rice, it is very difficult to stabilize and maintain in succeeding generations the heterosis, the multiplicity, and the unity of the sterling properties that exist universally in the first generation. This is the principal difficulty currently confronted with polyploid varieties.

Success in the breeding of rice from three lines and the rapid expansion of hybrid rice in production has, both from a theoretical and practical standpoint, solved problems involving use of heteroses in self-pollinating crops such as rice. In hybrid rice there has been a rather good unification of the conflict between large spikes versus numerous spikes, revealing the clear superiority of the grains in the spike, which has raised rice yields to a new level. But in that most critical component of yields--the weight of grains--hybrid rice has clearly been restricted by the grain weight of the three lines. That is to say that the grain weight of the three lines currently being used has become the chief factor inhibiting further increases in rice yields. If the dominance

of hybrid rice grains could be combined with the characteristic large grains of polyploid rice, the raising of rice yields to an even higher level might be possible. This is a problem meriting inquiry. For this reason, we tentatively proposed the idea of breeding a polyploid rice of three lines and matching it with polyploid rice hybrids, and in 1976 research got underway in this direction. The preliminary results of 3 years' work are now summarized below.

1. Materials and Methods

In order to breed polyploid rice of three lines, it is first necessary to have some polyploid rice material, and this new kind of thing that does not exist in nature must be artificially created. We used materials devised by ourselves and combinations introduced from elsewhere to solve this problem of rice variety materials. First of all, the object of our breeding was polyploid rice of three lines, and the plants targeted for induced changes had to possess reproducible factors of male sterility, male sterility in the sterile free line, and a male restorer. For these reasons, we used the principal existing three-line diploid rice and three-line hybrids as key materials for inducing changes, and we used the method of treating young shoots with either colchicine or an aqueous solution of fuminnong [1381 3046 6593]. All in all three-line rice materials were given 22 applications, three-line hybrids 22 applications, ordinary hybrid varieties 17 applications, and diverse varieties 21 applications. A total of five hybrids including "Nanyou No 3 (4n)," and "Zaoyou No 2 (4n)" were obtained as well as a group of other materials with induced changes. The process of treatment was: 0.04 percent aqueous solution of colchicine applied at the base of the young rice shoots (in a cut) to soak them 4 days and nights or 0.01 percent suspended solution of fuminnong to soak the glume buds 2 days and nights. Success rate was between 18 and 25 percent. In the course of the work we obtained the direction of Teacher Bao Wenkui [7637 2429 1145] of the Crop Institute of the Chinese Academy of Agriculture who also provided us with 50 selected hybrid lines of 17 hybrid combinations, thereby enriching our breeding materials.[1] It was with this group of materials that work began on the breeding of three-line polyploids.

2. Breeding of the Male Sterile Line and the Sterile-Free Line

During the winter of 1976, we took "Nanyou No 3" and "Zaoyou No 2" hybrids together with "Erjiunan No 1B (4n)" to Hainan where we planted a total of 60 plants. Aside from "Erjiunan No 1B," which w uniform in characteristics, the two hybrids developed divergences in their characteristics and fertility. From these we selected highly sterile plants and totally sterile plants for crossing with "Erjiunan No 1B" to check out their capability to maintain sterility. From almost 1,000 blooms on the hybrids, not a single hybrid grain was obtained. We had only to separate the

[1]One of the 50 originated in the Lodian Institute of Agriculture.

plants and take the seeds as best we could, then transport the root stock of the rice back to the Guizhou institute for planting. Plants from which seeds could be collected numbered a maximum of one with 38 spikes from which 213 seeds were taken, with one plant yielding only one seed. The seeds were used to plant 29 C_2F_3 plant lines. The characteristics and fertility of these plant lines continued to diverge. From the rice plant root stock that had been brought back, through paring of the tiller and cuttage, 20 asexual C_1F_2 plants were grown. From these materials highly sterile plants continued to be selected, their stamens killed with heat, and continued crossing carried out with "Erjiunan No 1B," while at the same time the scope of test crossings of materials introduced from elsewhere was expanded. Five combinations were built in nine plant hybrids. Of these, "Nanyou No 3" highly sterile plants were the female parent, and the four pairs of plants of the "Erjiunan No 1B" hybrid as well as the two pairs of plants of the "123 Ai" hybrid all exhibited complete infertility in first generation test crossing. Fertility is shown in Table 1.

Table 1. Fertility of First Generation Test Crossings

Combination	Total number of plants	Number of totally infertile plants	Percentage of totally infertile plants
"Nanyou No 3" C_2F_3 9023-2 X "Erjiunan No 1B" 9007-8	3	2	66.7
"Nanyou No 3" C_1F_2 903-3-1 X "Erjiunan No 1B" 9007-8	1	1	100.0
"Nanyou No 3" C_1F_2 903-4-2 X "Erjiunan No 1B" 9007-8	1	1	100.0
"Nanyou No 3" C_1F_2 903-4-2 X "Erjiunan No 1B" 9007-7	1	1	100.0
"Nanyou No 3" C_1F_2 903-4-2 X "123 Ai" 9057-2-3	1	1	100.0
"Nanyou No 3" C_1F_2 903-4-5 X "123 Ai" 9062-1-3	3	3	100.0

The shape of the pollen of the male sterile lines maintained the aborted characteristics of the classical "yebai," but there were also quite a few round aborted pollen. The anthers were thin and small and were dubbed "arrow-headed," were milky or light yellow in color, and did not split. Aside from partial continued use of original male parents for backcrossing, the test crossings selected for use only sterile line and expanded the

scope of the test crossings. The infertility of the first generation backcrosses remained stable. The fertility of some first generation backcrossed plant pairs has been arranged in Table 2.

Table 2. Fertility of First Generation of Backcrosses

Combination	Plant No.	Total No. of pollen grains observed with mirror	Number of infertile pollen	Number of normal pollen	Rate of infertile pollen (%)
"Nanyou No 3" C_1F_2 903-4-5	1	891	890	1	99.9
	2	852	852	0	100.0
X	3	948	948	0	100.0
"123 Ai" 9062-1-3	4	883	883	0	100.0
"Nanyou No 3" C_2F_3 9023-2 X "Erjiunan No 1B" 9007-8	1	737	737	0	100.0

The sterile-free line, "Erjiunan No 1," is a polyploid original variety with uniform characteristics, but with poor economic properties. Despite three generations of systemic breeding, after doubling the fruiting rate remained at about 20 percent, and though the weight per thousand grains increased to about 34 grams, the average number of grains per spike was only about 45 and the number of spikes per plant was about 15. We used it temporarily as a sterile-free line but no longer backcross it. "123 Ai" sterile-free line is a crossbreed of "123 X Zizizhan." Its principal characteristics have begun to stabilize, and the results of sample testing are shown in Table 3. It may be seen from Table 3 that the sterile-free line "123 Ai" is consistent in its time of ripening and that the height of plants is between 90 and 97 millimeters for a variation of less than 10 millimeters or virtually uniform. The average number of grains per spike is between 70 and 80 for a variation of about 10 grains. The fruiting rate stands around 80 percent, the lowest being 72 percent for a variation between highest and lowest of 10 percent. The per thousand weight is stable at between 37 and 38 grams. By way of making further appraisal of the degree of its stability, individual plants continue to be selected from among backcrosses of combinations and individual plants are also being combined and inspection of large plant colonies carried out.

Table 3. Sample Test Data for the "123 Ai" Sterile-Free Line

Number of test sample	No. of spikes per plant	Average number of grains per spike	Fruiting rate (%)	Per thousand weight (grams)	Plant height (mm)	Consistency in ripening
1	16	73.4	78.9	37.3	91	Simultaneous
2	17	68.1	79.3	37.0	90	"
3	18	81.7	81.7	37.0	92	"
4	8	80.8	82.3	38.0	97	"
5	14	75.0	72.0	37.1	91	"
6	21	69.6	79.1	37.0	95	"

3. Selective Breeding of the Restorer Line

a. Selective Breeding of Restorer Lines of Equal Quality

Prior to the development of a tetraploid original variety of rice with restorer elements, we tried to follow the method of selective breeding of a restorer line of equal quality used with ordinary diploid hybrids. From the generation of tetraploid hybrid that derived from the doubling of a hybrid, restorer material of equal quality was bred as a transitional means of solving the restorer line problem. Research confirms that this method is workable. From 1977 test crossings of first generation sterile colonies resulting from a cross of "Nanyou No 3" C_1F_2 903-4-5 X "123 Ai" 9062-1-3 was selected a totally sterile plant numbered 9030A of which some tassels were used to continue backcrossing with "123 Ai." Some of the other tassels were used as restorer material, "Zaoyou No 2" C_2F_3 9056-3, to make test restoration. Plants from the first backcrossed generation all remained sterile. Results of test restoration are shown in Table 4. Table 4 shows that fertility was partially restored with an average restoration rate of 22.8 percent, the highest being 47.7 percent. Examination of pollen with an observation mirror revealed that the pollen infertility rate declined correspondingly with an average 39.2 percent, a maximum of 60.5 percent, and a minimum of 24.7 percent. Such a low and uneven degree of restoration has no practical value for production, but inasmuch as the sterile material and the restorer material generations used in this test crossing were all very low and inasmuch as characteristics had not yet stabilized and the fruiting rate of the restorer materials themselves was only 45.5 percent, it was to be expected that the degree of restoration would not be high. If through breeding the fruiting rate of the restorer material could attain normal levels, it might be possible to select from them restorer lines possessing full restorer power. This possibility may be realized through continuous selection of later generation hybrids. Of 19 individual plants preliminarily selected from a plant colony of 90

plants of "Zaoyou No 2" C_5F_6 9041, except for four plants with a fruiting rate of between 55 and 59 percent, another 10 showed a fruiting rate above 60 percent, five were above 70 percent, and the maximum single plant was 74.7 percent. The fruiting rate of "Nanyou No 2" for that same year was only 62.1 percent; consequently a fruiting rate of around 70 percent may be considered nearly normal. Individual plants with a similar rate of fruiting are not rare among the restorer materials (Table 5). But the fruiting rate problem can be considered finally answered only when all single lines in plant colonies attain a normal and stable degree of fruiting. Possibly some of the above lines will fulfill these requirements after several more generations of selection. A solution to the problem of the fruiting rate of restorer materials themselves will provide a basis for the selection of materials possessing full restorer strength.

Table 4. Fertility Restoration of 9030A X "Zaoyou No 2" F_1

Number of plant sample	No. of spikes per plant	Average number of grains per spike	Degree of restoration (%)	Percent of infertile pollen	Per thousand weight (grams)
1	6	176.1	18.9	27.5	34.0
2	7	145.3	47.7	24.7	33.8
3	7	105.0	44.5	31.1	36.7
4	6	160.2	13.4	33.5	38.0
5	6	154.5	2.9	58.0	--
6	7	179.3	9.7	60.5	33.0
Average	6.5	153.5	22.8	39.2	35.1

Table 5. Principal Traits of Some of the Plant Lines Provided as Restorer Materials

Plant line number	Generation	No. of spikes per plant	Average number of grains per spike	Fruiting rate (%)	Per thousand weight (grams)
9027-1	C_4F_5	5	94.4	70.3	36.6
9041-1	C_5F_6	9	71.4	71.4	35.5
9041-8	C_5F_6	8	83.0	74.7	36.7
9041-16	C_5F_6	10	94.8	71.1	36.5
9042-2	C_5F_6	8	82.5	72.0	35.5
9059-10	C_5F_6	12	100.3	74.9	35.0
9023-1	C_4F_5	7	120.6	64.8	40.8
9022-3	C_4F_5	7	108.3	64.9	39.3
9030-5	C_4F_5	5	119.0	50.3	42.0
9033-1	C_5F_6	8	109.5	55.1	40.0
9059-6	C_5F_6	11	91.9	55.3	40.4
9119-1	C_4F_5	10	83.9	51.0	41.3

b. Hybrid Crossbred Restorer Lines

It must be considered that there is a definite limit to the matching of restorer lines of equal quality with combinations of strong heterosis. Therefore, concurrently with the selective breeding of restorer lines of equal quality, we are beginning hybrid crossbreeding work on the selection of restorer lines with characteristics of superiority, strong restorer strength, and great combining heterosis. From among succeeding generations of some hybrid combinations have been obtained types possessing superior traits, and a near-normal fruiting rate (Table 6). We are in the process of combining and selecting, to make tests of restorer strength. We select and test as we go along in order to accelerate the progress of breeding.

Table 6. Principal Traits of Some Plant Lines of Two F_3 Combinations of Hybrid Crossbred Restorer Lines

Combination	Plant line number	No. of spikes per plant	Average number of grains per spike	Fruiting rate (%)	Per thousand weight (grams)
H_{302} 123 A1 X No. 1	9009-12	13	121.5	70.5	39.5
	9009-18	12	108.6	74.1	39.6
X	9010-6	12	123.3	74.4	40.3
	9010-12	8	142.5	67.5	41.1
"Nanyou No 3"	9011-4	9	127.4	74.5	41.0
	9011-6	9	88.3	77.2	40.7
"Zaoyou No 2" X	9019-2	7	116.0	70.7	39.0
H_{365} No 5 X Ainante	9019-4	10	126.9	62.0	38.5
	9019-5	8	85.5	64.1	40.2

4. Discussion of Problems

Research with common diploid hybrid rice has overcome three problems: the matching of three lines into a unit, heterosis combination, and seed propagation yields, only after which was success possible in the use of these hybrids in large area production. Successful breeding of polyploid hybrids will also require that these three problems be overcome. This paper will now take up the two problems for discussion.

a. The Heterosis Problem in Polyploid Rice Varieties

Do polyploid rice varieties have heterosis? That is to say, can polyploid rice unify in a single generation the conflict between the trait of large grains and the trait of large spikes with numerous grains and numerous spikes thereby bringing about a leap in yield heterosis? This is the goal

of our selection and breeding work. In their work titled, "Research in the Breeding of New Varieties of Polyploid Rice," Bao Wengui and Yan Yurui [0917 5148 3843] talked about autotetraploid varieties, "Yinfang," "Shuiyuan," and "Chuannong 422" whose seeds per spike numbered 56.3, 58.6 and 69.1 respectively, and whose per-thousand weight was 32.9 grams, 30.3 grams and 29.1 grams respectively. But in crosses of "Yinfang X 422," and "Shuiyuan X 422," six of seven first generation hybrid plants averaged in excess of 130 grains per spike with one plant attaining 195 grains. The per-thousand weight of grains from four plants exceeded 40 grams. If figured on the basis of 139.9 grains per spike of the seven plants, the number of grains per spike of the hybrid was 248.5 percent that of the female parent, "Yinfang," 238.7 percent of "Shuiyuan," and 202.5 percent of the male parent, "422." The per-thousand weight of the seeds thus shows a 7 to 10 gram increase over that of the male and female parents. At the same time, it was also observed that the tillering strength of the hybrid was quite strong, plant growth quite vigorous, and the quality of seeds far superior to that of the parents. This is a primary illustration that polyploid hybrid rice possesses strong heterosis. The data we have arranged in Table 4 also illustrates that: no matter if the sterile materials and restorer materials generation used were very low and traits not yet ideal or stable, the first generation still revealed observable heteroses. The per spike number of grains in six hybrid plants were all in excess of 100 and averaged 153.5 with two plants having 175 grains per spike, one plant more than 160, two plants more than 145, and one plant with a maximum 179.3. The per-thousand weight of the seeds reached a 38 gram maximum, an average of 35.1 grams, and a minimum of 33 grams. Theoretical yields figured in terms of normal restoration of 85 percent, and average plants with 200,000 spikes per mu, per mu yields would be above 1,800 jin. If per-thousand weight rose to 40 grams (easily attainable with polyploid rice), yields would exceed 2,000 jin per mu. This gives us a look at the future vistas of polyploid rice heterosis. The crucial problem here is the selection and breeding of three lines of polyploid rice for production use.

b. The Problem of Three Matched Polyploid Lines

Among existing materials for polyploid rice we have already found "Yebai" type and "Xingyu" type male sterile materials and have successfully maintained them. We have also preliminarily found restorer materials that possess partial restorative powers for "Yebai." It may be supposed that the problem of breeding three lines of polyploid rice has been virtually solved in that we have completed the first step . matching three lines in 3 years time. But many difficulties remain in the matching required for polyploid rice varieties. First of all, polyploid rice is an artificially created type for which resources from which we can make selections are much scarcer than for ordinary diploid rice. Secondly, the difference between purity and mismatching in succeeding generations of polyploid rice is (1/18)" while it is (1/2)" with ordinary diploid rice making the stabilization of traits extremely difficult. We realize the

need in our work to take hold of the main conflicts, first resolving the factors that play a key role in production such as plant height, whether ripening is early or late, and spike and grain traits, making these relatively stable so that the hybrids may be put into production, and while in use combine three original lines and continue to add generations to make selection. On such a premise, the organization of forces and coordinated warfare to overcome the difficulty of matching three lines within a short period of time to produce polyploid rice hybrids is possible.

9432
CSO: 4007

BRIEFS

BEIJING AGRICULTURAL SEMINAR--A National Seminar on Dialectics of Agricultural Sciences, the first of its kind ever held in the PRC, was recently held in Beijing with agronomists and workers of natural dialectics from 29 provinces, municipalities and autonomous regions, and representatives from the State Science Commission and other academic units participating. The meeting stressed that objective economic law and natural law must be considered in order to realize agricultural modernization. The seminar invited 18 agricultural specialists and workers of natural dialectics to give lectures and a series of issues concerning agriculture, animal husbandry, fishery, farm machinery, molecular heredity, genetic engineering, photosynthesis, ecology and other basic biological sciences were discussed. Comrades from some 50 institutes of higher education on agriculture and forestry also exchanged teaching and research experience. [OW010216 Beijing XINHUA Domestic Service in Chinese 0201 GMT 23 Oct 79 OW]

CSO: 4007

BRIEFS

GUOYANG COUNTY AUTUMN CROPS--According to ANHUI RIBAO, Guoyang County, Anhui, had planted autumn crops on 700,000 mu as of 20 October, constituting 64 percent of the acreage listed in the autumn planting plan. In addition, the county plans to expand the acreage for wheat and barley by 100,000 mu to make up for the losses caused in this autumn due to natural disasters. The county has also prepared 4,200 tons of chemical fertilizer and 100 tons of insecticides. [Hefei Anhui Provincial Service in Mandarin 1100 GMT 28 Oct 79]

HUOSHAN COUNTY AFFORESTATION--As of 20 October, Huoshan County of Anhui Province had collected over 120,000 jin of saplings of maple and mulberry trees, and over 70,000 jin of saplings of camellia and tung trees. [Hefei Anhui Provincial Service in Mandarin 1100 GMT 29 Oct 79 OW]

COTTON PRODUCTION--Anqing Prefecture, Anhui Province, has reaped a good harvest of cotton in its 470,000 mu of cotton fields. By 29 October, Anqing Prefecture has bought 331,700 dan of cotton, marking an increase of 3 percent or 42,500 dan over that of the same period last year. The purchasing price for each dan of cotton is now 150 yuan, an increase of 30 yuan over that of last year. [Hefei Anhui Provincial Service in Mandarin 1100 GMT 2 Nov 79]

AGRICULTURE CROPS--Guzhen County, Anhuei Province, reaped a bumper wheat harvest from 650,000 mu and sold 27.41 million jin of summer grain to the state far above the planned target of 18 million jin. This county has a population of 400,000 tilling 1.2 million mu of arable land. [Beijing Xinhua Domestic Service in Chinese 0250 GMT 27 Oct 79 OW]

WHEAT SOWING--AS OF 22 October, approximately 4.5 million mu of wheat and 210,000 mu of rapes were sown in Fuyang Prefecture, Anhui. Wheat sowing plan of 1.1 million mu was fulfilled in Bo County alone. [Hofei Anhui Provincial Service in Mandarin 1100 GMT 24 Oct 79 OW]

CSO: 4007

BRIEFS

GANSU BEEKEEPING CLASS--Recently the Ministry of Agriculture has sponsored a training class on beekeeping in Dingxi Prefecture, Gansu Province. Over 140 cadres and commune members from Shaanxi, Gansu and Ningxia are attending the class, which will last about 1 month. At the 15 October class-opening ceremony, Ma Defeng, president of the China Apiculture Society and deputy director of the Beekeeping Institute of the Chinese Academy of Agricultural Sciences, spoke on the importance of beekeeping. [SK240224 Lanzhou Gansu Provincial Service in Mandarin 1125 GMT 21 Oct 79 SK]

CSO: 4007

AVERAGE GUANGDONG PEASANT'S INCOME UP 10 YUAN

Hong Kong TA-KUNG-PAO in Chinese 31 Aug 79 p 1

[Article: "Guangdong Carrying Out Rural Policies Is Welcomed; Peasant Incomes Increase and the Supply of Sidelines and Foodstuffs Is Up"]

[Text] Guangzhou CHINA NEWS AGENCY 30 Aug--At the beginning of this year, Guangdong Province began to raise one after another the procurement prices of 111 agricultural and sideline products, including grain, edible oils, sugar cane, pigs and fish. The increase in peasant incomes further aroused the production enthusiasm of the recipients, with the amount of agricultural and sideline products on the markets and purchased by commercial units all increasing.

The increase in Guangdong's procurement prices of agricultural and sideline products can increase peasant income by 442.43 million yuan a year, or 9.81 yuan per capita for the farm population. Because the agricultural production conditions differ from area to area, the increases in peasant incomes also vary.

By carrying out the various rural economic policies and also raising the procurement prices of agricultural and sideline products, Guangdong Province has promoted the development of agricultural and sideline production. The agricultural situation has taken on a new change. According to the statistics, the increase in the cultivated acreage of oil-bearing crops, citrus and manioc was comparatively great. The cultivated acreage of peanuts this year has increased by 6.6 percent over last year, soya bean by 6.26 percent and manioc by 22 percent. Xinhui County increased its citrus area by 3,600 mou over last year. In this year's summer harvest, the province reaped bumper crops of rice, peanuts and soy.

Although the procurement prices of agricultural and sideline products have been raised, the sales prices of grain, edible oils and sugar have not moved. The market prices of some agricultural and sideline products have been suitably adjusted, but the government has adopted appropriate measures, including raising wages and issuing supplementary bonuses to raise the income of workers and staff, so as to guarantee that the daily life of urban workers and staff is gradually improved.

11723
CSO: 4007

BRIEFS

HEILONGJIANG WHEAT STRAIN--A researcher and his assistants from the Keshan Institute of Agricultural Science and Technology, Heilongjiang, have successfully introduced a good wheat strain named "(Kefeng) No 2," which has proven to be both productive and disease-resistant, by cross breeding various wheat varieties. This year Heilongjiang has planted 150,000 mu of "(Kefeng) No 2," and per-mu output in some plots has reached as high as 800 jin. [OW011333 Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 23 Oct 79 OW]

HEILONGJIANG GRAIN, PROCUREMENT FORUM--The Heilongjiang Provincial Revolutionary Committee recently held a grain procurement conference to study and work out plans for this year's grain procurement. Comrade Chen Lei presided over the conference and made a report. The conference called on all localities to implement the CCP Central Committee and State Council documents on grain procurement and to pay due attention to the interests of the state, the collectives and individuals. [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 24 Oct 79 OW]

HEILONGJIANG FARMLAND IMPROVEMENT--On the evening of 27 October, the Heilongjiang Provincial CCP Committee and Revolutionary Committee held a telephone conference calling on all localities in the province to stimulate an upsurge of building farmland capital construction projects in the next 2 or 3 weeks. Zhao Dezun presided over the conference and (Wang Luming) addressed it. According to the conference report, some 900,000 persons are engaged in building farmland improvement projects in Heilongjiang. Insufficient rainfall this year has caused deficient autumn irrigation to many farmland plots and droughts are still possible in the province in the spring of 1980. The conference urged all localities to accelerate the completion of water conservancy projects under construction and develop water sources to insure sufficient autumn irrigation and prepare for possible droughts. [SK050316 Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 28 Oct 79 OW]

HEILONGJIANG NATURAL RESOURCES INVESTIGATION--A number of scientists and technicians in Heilongjiang recently conducted on-the-spot investigations on the Sanjiang Plain, with emphasis on the investigation of

natural resources in the region. They conducted field investigations on 22 aspects, including water resources, agriculture, hydrology, hydrological geology, water conservancy engineering, landforms, soil, wild animals, vegetation, environmental protection, agricultural mechanization, roads and habitation. They also conducted studies on rational structure and distribution of agricultural production, rational use and protection of natural resources, and conditions for ecological balance. [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 28 Oct 79 OW]

GREEN MANURE FIELDS--Heilongjiang has expanded the area of green manure fields to over 100,000 mu in recent years. There are 25 counties and municipalities with large-tract green manure fields. [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 24 Oct 79 OW]

GRAIN OUTPUT--Heihe Prefecture, Heilongjiang, has reaped a good harvest on its 4.5 million mu of cereal crops this year. As of 21 October, the prefecture had delivered more than 200 million jin of grain to the public granaries, or 50 percent of the procurement target. [Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 23 Oct 79 OW]

POTATO HARVEST--Longjiang County, Heilongjiang, organizes local communes and brigades to strengthen processing of potatoes. This year, the county has reaped a good harvest from its 110,000 mu of potatoes with a total yield of 100,000 dun. It has a surplus of 43,000 dun of potatoes this year. [Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 22 Oct 79]

CSO: 4007

BRIEFS

HUNAN IRRIGATION SYSTEM--Changsha, 2 Nov--A new irrigation system with 200 reservoirs, 1,030 tunnels and aqueducts, and 1,100 kilometres of channels and ditches has been completed and is now in use in Shaoyang Prefecture in central Hunan Province. It irrigates 36,000 hectares of farmland. The project includes seven hydroelectric power stations with a total generating capacity of 6,000 kilowatts. Construction of the Dazhen irrigation system was started in 1965. The Dongfeng channel, one of the first sections completed, irrigated 3,300 hectares of early rice this year. Output increased 1,150 tons over 1978. [Text] [OW040623 Beijing XINHUA in English 0215 GMT 2 Nov 79 OW]

CSO: 4007

BRIEFS

JIANGSU DROUGHT CIRCULAR--The Jiangsu provincial CCP and revolutionary committees issued a circular calling on all localities to organize manpower to make autumn harvesting and sowing a success in defiance of drought which has hit the province in the past month. The circular emphasized proper organization of manpower, protection of seedlings, consistent implementation of the party's policy governing procurement of agricultural and sideline products at a fair price, and support of autumn harvesting and sowing by all professions and trades. [Nanjing Jiangsu Provincial Service in Mandarin 2300 GMT 27 Oct 79 OW]

XINGHUA COUNTY GRAIN PRODUCTION--In 1978, Xinghua County in Jiangsu produced a total of 1.68 billion jin of grain, of which 572 million jin were sold to the state. The total income from such grain sale amounted to 70.44 million yuan. With the increase of government procurement prices for farm and sideline products, the county's total income in 1979 is expected to increase by 20.67 million yuan. [Beijing XINHUA Domestic Service in Chinese 0235 GMT 1 Nov 79 OW]

WHEAT PLANTING--Feng County, Jiangsu, has planted 680,000 mu of wheat, barley and naked barley. [Nanjing Jiangsu Provincial Service in Mandarin 2300 GMT 20 Oct 79 OW]

CSO: 4007

BRIEFS

GANZHOU PREFECTURE SUGARCANE PRODUCTION--In 1978, Ganzhou Prefecture, Jiangxi, reaped 386,000 tons of sugarcane from its 160,000 mu of sugarcane fields. In 1979, the prefecture's sugarcane production is expected to exceed 450,000 tons. [Beijing XINHUA Domestic Service in Chinese 0323 GMT 28 Oct 79 OW]

CSO: 4007

BRIEFS

JILIN TO POPULARIZE NEW RICE--The Jilin Provincial Agricultural Bureau recently held an on-the-spot meeting in Gongzhuling to popularize the advanced paddy rice cultivation technique from Japan. Experiments in cultivating high-yield paddy rice had been conducted by Japanese specialists at the Paddy Rice Research Institute under the Jilin Provincial Academy of Agricultural Science and the results proved successful. Experiments showed that despite the unfavorable natural conditions of little sunlight and low temperatures, this new strain of paddy rice could still maintain high yield and the average per mu yield reached 1,063 jin. A detailed analysis of the cultivation technique was given at the on-the-spot meeting. [Changchun Jilin Provincial Service in Mandarin 0430 GMT 27 Oct 79 SK]

CAPITAL CONSTRUCTION CIRCULAR--The Jilin provincial farmland capital construction headquarters issued an emergency circular on 29 October, calling on all localities to create a new high surge in farmland capital construction. The circular says that by 20 October, some 610,000 people had plunged into the construction and some 1,500 projects are being built. It goes on to say that Siping and Jilin prefectures have achieved fairly notable results in construction, but other localities are either slow in action, unable to give specific directions, or simply taking a laissez-faire attitude. The circular demands that: 1) farmland capital construction be carried out persistently on the basis of local conditions and with actual benefit guaranteed, 2) more manpower be transferred to it, and 3) party committees strengthen leadership over it with principal responsible persons grasping it personally. [SK010156 Changchun Jilin Provincial Service in Mandarin 1100 GMT 29 Oct 79 SK]

CSO: 4007

BRIEFS

LIAONING AFFORESTATION--Liaoning Province recently held its first conference on afforestation of plains, setting forth a definite plan for carrying out afforestation in any given period and establishing a network of windbreaks to protect farmland. [Shenyang Liaoning Provincial Service in Mandarin 2200 GMT 2 Nov 79 SK]

CSO: 4007

PRELIMINARY ANALYSIS OF WIND, LIGHT AND HEAT CONDITIONS OF STRIP INTERCROPPING FARMLAND

Beijing QIXIANG [METEOROLOGY] in Chinese No 10, Oct 78 pp 36-37

[Article by Farming and Livestock Meteorology Laboratory of the Nei Monggol Meteorological Institute: "Preliminary Analysis of Wind, Light and Heat Conditions of Strip Intercropping Farmland"]

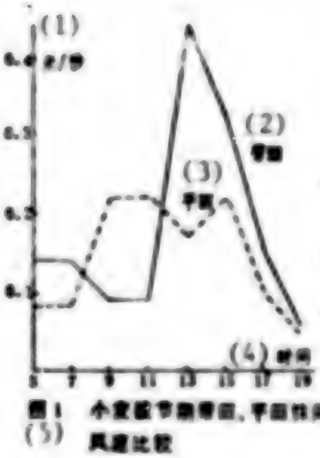
[Text] The Tumotechuan region of Nei Monggol is strip intercropping wheat and maize in strips measuring 5 x 5 chi and 5 x 8 chi and interplanting potatoes with wheat before the wheat is harvested or interplanting soybeans between rows of maize. They are also using strip-planting patterns of 7 x 2 chi strips planting wheat in strips 6 cun wide with 6 cun between rows, and planting maize in double rows of 2 stalks with a distance of 1 chi between each row of stalks, or a space of 2 stalks. In some cases they use strips 3 x 3 chi wide with four rows of wheat and two rows of maize. This improves the structure of the crop colonies and their microclimatic conditions, increases the productivity of photosynthesis, and increases the accumulation of dry material. Almost 4 years of experiments demonstrate that using several different patterns of strip farming in different 1,000 and 1,400 jin per mu, which were double the local yields obtained from local fields (hereinafter called flat fields).

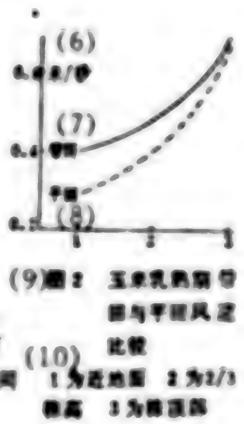
1. Strip Farming Has Improved the Crop Ecology

a. Spacing has enhanced the random exchange between rows of stalks.

The stalks of plants form an obstacle to the free circulation of air. The closer together the plants, the lower the velocity of the wind among them and the poorer the ventilation. But in the crop colony structure of strip farming with plants of different heights that are spaced, the microclimate of the fields differs from the usual. Take the case of strip fields of wheat and maize measuring 5 x 5 chi, for example. In what fields laid out in strips, plant stalks total 420,000 per mu, while maize fields laid out in strips have 7,500 stalks of maize per mu. Inasmuch as the spacing between strips differs, obstacles to the flow of air are unequal close to

the ground, enhancing random exchange and increasing wind velocity. During the period when the wheat is elongating, for example. Average daytime wind velocity in strip fields is 0.17 meters per second with maximum speeds of 0.44 meters per second and the maximum range of wind velocity among the stalks being 0.39 meters per second. By contrast, in flat fields, average wind velocities among the stalks are 0.14 meters per second with maximum velocities of 0.22 meters per second and a maximum range of 0.14 meters per second (See Chart 1). Tests conducted in strip fields of wheat before the wheat had come into milk showed that the daytime deviation in each increment of wind velocity, as compared with flat fields, was greatest two-thirds of the way up the stalks. Once the wheat was harvested, the role of the wheat strips as a wind corridor made each increment of wind velocity in maize strip fields superior to that of flat fields (See Chart 2).





Key:
- (1) meters per second
- (2) strip fields
- (3) flat fields
- (4) time
- (5) Chart 1. [title below]
- (6) meters per second
- (7) strip fields
- (8) flat fields
- (9) Chart 2. [title below]
- (10) 1. close to the ground
  2. 2/3 of the way up stalk
  3. tip of the stalk

Chart 1. Comparison of wind velocities in strip fields and flat fields during the elongation period for wheat.

Chart 2. Comparison of wind velocities in strip fields and flat fields of maize at the milk ripe stage.

b. Differences in heights enhance use of heat resources.

During the early stages, the wheat planted in strip fields of wheat and maize (or gaoliang) was "Moda" and "Moka," which are varieties of wheat from Mexico whose stems reach heights of between 50 and 70 millimeters. Maize was Weier 156 of Jishuang No 4 varieties with a long growth period and whose stalks grow between 270 and 300 millimeters tall. Except for a period of 5 to 7 days during the period of elongation when the stalks of both the wheat and the maize that were strip intercropped were about the same height, the height of the stalks of corn exceeded the height of the stalks of wheat following the elongation period. Because of the alternations in height of plants in strip fields, heating is uneven with random

currents being enhanced; consequently changes occur in the crop colonies. Tests have shown that between ear formation and spike formation (when the leaves are most luxuriant) in strip fields of wheat, the temperature among stalks is higher by 1 to 2°C. Following the milk ripe stage, temperatures among stalks in strip fields are lower by between 1 and 2°C than in flat fields. That is to say that during the early stages of wheat growth when conditions for ventilation and light penetration are good, temperatures among the stalks is high. Later on, with high plant stalks making shade on both sides with a reduction in the period of light and its intensity, the temperatures among the wheat stalks is lower than in flat fields. This is of benefit in reducing and preventing "bacterial wilt," and "early maturation," which are brought on by high temperatures. Experiments conducted in 1977 show that under identical conditions of high temperatures, the per thousand weight of wheat grain from flat fields was 37.5 grams while the per thousand weight of wheat grain from strip fields reached 39.4 grams or 1.9 grams heavier than from flat fields.

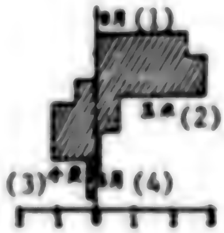
Strip farming can make full use of the heat resources of the entire growing season. Take, for example, the strip intercropping of wheat and maize. Once the wheat has flowered, potatoes are intercropped. During its period of growth wheat requires $\geq$ 3°C active accumulated heat of between 1,900 and 2,100°C. Potatoes planted between rows of wheat sprouted at the end of June. The potato plants and the wheat grow together for a period of 20 days during which the $\geq$ 3°C active accumulated heat was 423.1°C. Once the wheat was harvested, the potatoes still had 65 days of growth left and could use $\geq$ 3°C active accumulated heat of 1,300°C to use more than $\geq$ 3°C active accumulated heat of 1,700°C as compared with the wheat alone, thus increasing use of heat by about 85 percent.

c. Leaf area coefficient's high distribution increases utilization rate of light energy.

Intercropping in different patterns can alter the various growing seasons of crops, can maintain luxuriant plant colonies in the fields that have rather high light energy use, and can extend both the light energy utilization time and avoid excessively high leaf area coefficients at a given time. Take Chart 3, for example. The leaf area coefficient for wheat, when it is at its most vigorous, is 1.1. Add to this the leaf area coefficient of maize for the same period, which is 0.6, and the total leaf

Chart 3. Comparison of Leaf Areas of Wheat and Maize in Strip Fields. Horizontal coordinate is leaf area coefficient.

Key: (1) September
(2) Maize
(3) Wheat
(4) May
(5) Chart 3. [title above]



(5)

coefficient for the entire field becomes 1.7 while the highest leaf coefficient for a flat field of wheat is 2.2, or larger by 0.5 than a strip field. The maximum leaf area coefficient for maize in a strip field is 2.8. Add to this the leaf area coefficient for wheat at the same period for a total of 3.4, while the leaf area coefficient for maize in a flat field reaches 3.9, or 0.5 greater than for a strip field.

The illumination period for crop colonies of wheat is 50 days longer for strip fields than for flat fields, and 20 days longer for maize. Inasmuch as the total area of photosynthesis throughout the fields is greater in strip fields than in flat fields during the growing period, utilization of light energy resources is fairly complete. Tests during 1975 in the Tumotechuan region show that annual total radiation from the sun was 141.677 kilocalories per square centimeter and the total amount of radiation from the sun during the period of crop growth (12 April to 14 September) was 79.870 kilocalories per square centimeter. If the physiologic radiation of the crops is figured as 50 percent of the total radiation, the amount of annual radiation in the Tumotechuan area is 70.838 kilocalories per square centimeter and the amount of radiation during the growing season is 70.838 kilocalories per square centimeter. The utilization rate of light energy for crop photosynthesis is

$$E\mu = \frac{K \cdot \Delta w}{\Sigma S}$$

In this formula, $E\mu$ is the utilization rate of light energy; K is the amount of heat from the combustion of 1 gram of dry material (4.25 kilocalories); Δw is the amount of increment of the dry material (grams per square meter); and S is the amount of physiologic radiation (calories per square meter per day).

As Chart 4 shows, during the period from spike formation to the milk ripe stage of wheat, for every square meter of leaf area, the daily amount of accumulation of dry material is 5.8 grams and average daily radiation during this period is 687.1 calories per square centimeter.

Therefore: $$E\mu = \frac{5.8 \times 4.25 \times 10^3}{687.1 + 2 \times 10^4} = \frac{24.65}{3436} = 0.0072,$$

Multiplied by an economic coefficient of 46 percent, $E\mu$ = 0.33 percent.

The average value of Δ w for the entire growing period is 3.3 grams per square meter per day; the average daily amount of radiation is 525.5 calories per square centimeter, or 0.23 percent based on wheat's utilization rate for light energy as calculated in the above formula; a light energy utilization rate of 0.8 percent for maiz , a light energy utilization rate of 0.08 percent for intercropped soybeans; a light energy utilization rate of 0.01 percent for broomcorn millet (Panicum miliaceum) intercropped among wheat rows; and a light energy utilization rate of 1.12 percent for the entire field with total yields of 1,289.9 jin per mu.

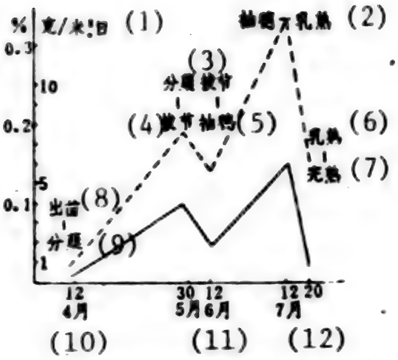


图4 带田小麦群体光能利用率

(13) 虚线为光能利用率（%）
实线为干物质增长量（克/米²·日）
（据1974、1977年资料）

Key:
(1) Grams per square meter per day
(2) Spiking to Milk Ripe Stage
(3) Tillering and elongation
(4) Elongation
(5) Spiking
(6) Milk-ripe
(7) Completely ripe
(8) Sprouting
(9) Tillering
(10) April
(11) May and June
(12) July
(13) Chart 4. [title below]

Chart 4. Light Energy Utilization Rate for Wheat Colonies in Strip Fields. Dotted line shows light energy utilization rate (%). Solid line shows increased amount of growth of dry material (grams per square meter per day).

When a great increase is made in the number of rows along the edge of strip fields planted to wheat and maize, the effects of light energy are extremely apparent, and ventilation conditions also improve not only over those of flat fields but over those of the inner rows of strip fields as well.

It may be seen from charts 5 and 6 that the intensity of illumination and wind velocity at the base of wheat rows along the porifera is clearly greater, on the average, than in the interior rows.

2. Increased Yields From Strip Intercropping Farming

a. Farming by the strip intercropping method can both regulate and improve the microclimate in the fields, increase the rate of photosynthesis production, increase the accumulated amount of dry material, and increase per unit of area yields (See Attached Table). In 1977 there were 3 mu of agricultural experimental fields with per mu yields of 1939.1 jin.

b. Farming by the strip intercropping method permits realization of the fullest benefits from the superior performance of the poriferal rows. In both wheat and maize, growth was luxuriant, spikes were large and kernels of grain numerous, and grains were full-bodied in the predominant number of poriferal rows. Analysis of data on maize yields from experiments

in Helin in 1977 show a double-spiking rate of 13 percent for poriferal rows, and a zero rate for stems without spikes. The double-spiking rate in the second row was 8 percent and the rate for stems without spikes was 1 percent. In the third row, the double-spiking rate was 1 percent and the rate for stems without spikes was 3 percent. In flat fields, however, the double-spiking rate for maize was zero; the rate for stems without spikes was 5 percent; and the weight per thousand grains was higher by 19 grams for strip fields.

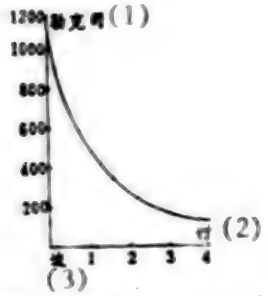


图5 带田小麦乳熟期边行和里行光照比较
(4)

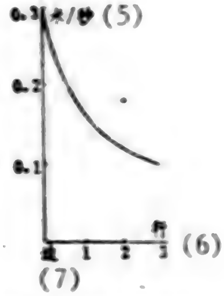


图6 带田小麦拔节期边行和里行风速比较
(8)

Key:
(1) Lux
(2) Row
(3) Edge
(4) Chart 5. [title below]
(5) Meters per second
(6) Row
(7) Edge
(8) Chart 6. [title below]

Chart 5. Comparison of Illumination in Edge Rows and Inner Rows of Wheat in Strip Fields During Milk Ripe Stage
Chart 6. Comparison in Wind Velocities in Edge Rows and Inner Rows of Wheat in Strip Fields During Elongation Stage

Attached Table

Year	Area (mu)	Experimental Field Yield (Jin per mu)	Normal Field Yield (Jin per mu)
1974	7.5	1108.2	574
1975	35.1	1032.0	764
1976	33.8	1209.6	816
1977	30.0	1441.9	800

Note: Yield from Normal Field means yield from the Erdaojie Brigade of the Bikeqi Commune.

The following preliminary results may be derived from the above:

a. Use of strip farming configurations transforms use of illumination by crop colonies from a two-dimensional plane to a three-dimensional plane with improvement in the conditions for photosynthesis. This has

great practical significance for reform of the farming system in our region with fullest use of the heat resources, which are sufficient for more than a single growing season but insufficient for two growing seasons.

The utilization rate for light energy in strip fields was just about doubled over what it is in flat fields. Generally speaking, the light energy utilization rate rose from 0.5 or 0.6 percent to 1.0 to 1.2 percent. In regions of Tumotechuan where water and fertilizer conditions are good, adoption of the above-described several strip farming configurations can produce stable yields upward of 1,000 jin per mu.

b. Better circulation of air and less shading in rows of strip fields was clearly effective in reducing frosting and freezing of autumn crops and in reducing the incidence of premature manuring of wheat caused by high heat.

c. Strip farming of wheat requires selection of varieties of wheat that mature early and have short stems, and long narrow strip configurations should be used so as to avoid shading when the maize is in its sprouting stage and the wheat is in its latter stage, which will adversely affect yields.

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BRIEFS

HANGQUI BANNER ANIMAL HUSBANDRY--Huhhot, 30 Oct--As a result of implementing fixed work and production quota and reward system, Hangqin Banner in Nei Monggol has scored fine achievements in animal husbandry this year. Total number of livestock reached 973,000 head. In 1978, the banner collected and stored 55 million jin of fodder grass. This year, it had already collected 60 million jin as of the end of September. [Beijing XINHUA Domestic Service in Chinese 0241 GMT 30 Oct 79 OW]

CSO: 4007

BRIEFS

QINGHAI FARMLAND IMPROVEMENT--The Qinghai provincial party committee held an on-the-spot meeting on farmland improvement at a commune in suburban Xining on 11 October. Present were more than 100 leading cadres from various prefectures, municipalities and counties, as well as the concerned provincial departments. Leading members of the provincial party committee Xu Linfeng and (Liang Guting) attended the meeting, and (Liang Guting) made a speech. The meeting urged all localities to build farmland improvement and water conservancy projects in the autumn in a big way. [OW261111 Xining Qinghai Provincial Service in Mandarin 1100 GMT 16 Oct 79 OW]

QINGHAI GRASSLAND SURVEY--Xining, 25 Oct--Survey of grassland shows there are 579 million mu of grasslands in Qinghai, or 50.2 percent of the province's total area. Of the 579 million mu of grasslands, the survey shows that 502 million mu can be used as pasture for animal husbandry. Work began to survey the grasslands of Qinghai in 1970. [OW311519 Beijing XINHUA Domestic Service in Chinese 0138 GMT 25 Oct 79 OW]

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BRIEFS

SHANDONG COTTON CONFERENCE--The Shandong Provincial Revolutionary Committee held a telephone conference on 29 October, calling on leaders and peasants in all cotton-growing areas to insure fulfilling and over-fulfilling this year's cotton procurement task. The conference pointed out that statistics released on 27 October showed that only 37.8 percent of cotton procurement tasks were fulfilled, worse than the same period of last year. Zhu Benzheng, vice chairman of the Shandong Provincial Revolutionary Committee, delivered a speech at the conference. [Jinan Shandong Provincial Service in Mandarin 2300 GMT 30 Oct 79 SK]

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BRIEFS

COUNTY GRAIN PRODUCTION--Aksu Prefecture in Xinjiang by 15 October over-fulfilled its 1979 summer grain procurement plan. The actual procurement was 1.36 million jin more than planned. In 1979, the prefecture produced 10 percent more summer grain than in 1978. [Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 21 Oct 79 OW]

YILI KAZAK GRAIN PRODUCTION--The Yili Kazak Autonomous Prefecture, Xinjiang, in 1979 increased grain output by some 130 million jin as compared with 1978. As of 20 October 1979, the prefecture procured 232 million jin of wheat and thus fulfilled 101.8 percent of its 1979 summer grain procurement plan. The 1979 wheat procurement was 38.9 million jin more than the 1978 wheat procurement. [Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 28 Oct 79 OW]

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BRIEFS

XIZANG ANIMAL DISEASE SURVEY--Lhasa, 22 Oct--Xigaze Prefecture, Xizang, carried out a general survey of animal epidermic diseases with the assistance of the Nei Monggol Aid-Xizang stockbreeding team from July 1978 to August this year. Government organs at all levels in the prefecture have organized leading groups to facilitate the survey. Leading cadres and veterinarians have traveled to 19 counties, 98 districts, 467 communes and more than 2,000 production brigades and livestock farms and have inspected 4.53 million head of animals, which account for 90 percent of the prefecture's livestock. The survey has led to understanding of the prefecture's major epidermic diseases and has provided scientific data for the prevention and cure of such diseases. [Beijing XINHUA Domestic Service in Chinese 0135 GMT 22 Oct 79 OW]

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BRIEFS

LORAN USE IN ZHEJIANG--Hangzhou, 28 Oct--The Zhoushan Marine Fishery Company in Zhejiang Province is popularizing the use of Loran charts of oceangoing fishing vessels. The Loran charts, designed by Hu Zhiliang, a navigation technician of the company, are based on data contained in the Loran tables published in Japan. Using the Loran charts, one can fix his ship's position in about 1 minute, with errors of less than one-half of a nautical mile. The six-piece sets of Loran charts are printed in color. [Beijing XINHUA Domestic Service in Chinese 0715 GMT 28 Oct 79 OW]

ZHEJIANG TELEPHONE MEETING--The Zhejiang Provincial Revolutionary Committee held a telephone meeting on 27 October calling for doing a good job of autumn harvesting and winter planting in rural areas throughout the province. The province planted late spring rice on more than 10 million mu. The meeting called for efforts to overcome a drought spell which began 10 October. [Hangzhou Zhejiang Provincial Service in Mandarin 0400 GMT 28 Oct 79 OW]

ANIMAL HUSBANDRY--Lishui Prefecture, Zhejiang, has organized cadres, veterinarians and technicians to survey pastureland and combat animal diseases so as to further develop animal husbandry in the prefecture. As of now, there are 2.76 million mu of pastureland and over 118,000 head of cattle in the prefecture, an increase of 3,200 head over that of the same period last year. [Hangzhou Zhejiang Provincial Service in Mandarin 1100 GMT 20 Oct 79]

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II. PUBLICATIONS

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